

CHAPTER 7

SITE SAFETY AND HEALTH PLAN REQUIREMENTS

7-1. General. A written site-specific safety and health plan is required to protect onsite personnel, the environment, and potential offsite receptors from the chemical and physical hazards particular to the UST site. The site safety and health plan (SSHP) must address all potential hazards and must present a plan of immediate action to protect all contractor's employees and USACE personnel and/or property. The SSHP must be followed during investigations, testing, repair/upgrade, removal, and all other UST-associated work. The contractor must be required to provide to the USACE, or an authorized representative, an SSHP before any work is initiated onsite in fulfillment of the contract or subcontract for UST work as directed by USACE. The contractor must utilize the services of a certified industrial hygienist (CIH) or a certified safety professional (CSP) experienced in hazardous waste site operations to oversee the development and implementation of the safety and health documents required by this section.

a. References. All site investigation and UST removal activities and safety and health documents must, at a minimum, comply with the following regulations:

- (1) Federal Acquisition Regulation (FAR) Clause 52.236-13: Accident Prevention.
- (2) USACE, *Safety and Health Requirements Manual*; EM 385-1-1 (latest revision).
- (3) OSHA *Construction Industry Standards*, 29 CFR 1926, and *General Industry Standards*, 29 CFR 1910; including but not limited to 29 CFR 1926.65 - *Hazardous Waste Operations and Emergency Response*.
- (4) NIOSH/OSHA/USCG/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, October 1985.
- (5) USACE, Guide Specification, CEGS-01350, *Safety, Health, and Emergency Response* (HTRW).
- (6) Other applicable federal, state, and local safety and health requirements.

b. Personnel. The SSHP must include but not be limited to:

- Phone numbers of all emergency response personnel associated with evacuation routes and assembly areas.

- Phone numbers and names of persons in the areas adjoining the UST site.
- A roster of all contractor's personnel onsite.
- Detailed directions and a map to the nearest medical facility.
- Other inclusions deemed necessary to ensure that all safety requirements are addressed.

Because of the nature of the flammable or combustible liquids that are stored in these tanks, hazardous conditions may arise in the work area during removal and subsequent handling of tanks. For this reason, all personnel involved onsite must be familiar with the potential hazards and know appropriate safety and health measures to ensure a safe working environment.

7-2. Submittals. The following safety and health documents are required for UST activities delineated in this manual. Avoid providing material of a general nature that is not related to the UST project or site. Information readily available in standard texts should be repeated only to the extent necessary to meet the requirements of this scope. The Safety and Health Program (SHP) should contain general information required by the referenced OSHA standard and EM 385-1-1. By comparison, the SSHP should be a brief document addressing site-specific safety and health requirements and procedures based upon site-specific conditions. Reiteration of general information contained in the SHP should be avoided in the SSHP.

- a. Safety and Health Program. The contractor must submit a copy of the SHP required by OSHA Standard 29 CFR 1926.65(b)(1) through (b)(4) with the initial SSHP. Information contained in this written program must be used by reference in the SSHP, as appropriate, to fulfill site-specific plan detail requirements.
- b. Site Safety and Health Plan. The contractor's SSHP required by 29 CFR 1926.65(b)(4) must be prepared by the contractor and submitted to the contracting officer for review and approval prior to the commencement of any onsite work by the contractor and/or subcontractors. The level of detail provided in the SSHP should be tailored to the type of work, complexity of site activities, and anticipated hazards. All topics required by OSHA 29 CFR 1926.65(b)(4) and those described below must be addressed in the SSHP. Where the use of a specific topic is not applicable to the project, a negative declaration supported by a brief justification must be given.
 - (1) Site Description and Contamination Characterization. Describe the location, topography, and approximate size of the site; the onsite jobs/tasks to be performed; and the duration of planned site activities. Compile a complete list of the contaminants found or known to be present in site areas. This listing should be based on results of previous studies; or, if not available, select the likely contaminants based on site history and prior

site uses/activities. Include chemical names, concentration ranges, media where found, locations onsite, and estimated quantities/volumes to be impacted by site work, if known. In addition, information should also be included for any other chemicals brought onsite to complete any tank removal or site characterization activities.

- (2) Hazard/Risk Analysis. Identify the chemical, physical, biological, and safety hazards of concern for each site task and/or operation to be performed. Analyze these hazards and develop procedures for their control. Selection of chemicals as indicators of hazard must be based on media concentrations, toxicity, volatility or potential for air entrainment at hazardous levels, and frequency of detection.

Describe chemical and physical properties of selected contaminants, sources and pathways of employee exposures, anticipated onsite and offsite exposure-level potentials, and regulatory (including federal, state, and local) or recommended protective exposure standards. Specify and justify "action levels" based upon airborne exposure hazards and direct skin-contact potentials for upgrades/downgrades in levels of personnel protection; for implementation of engineering and/or work practice controls; for emergency evacuation of onsite personnel; and for the prevention and/or minimization of public exposures to hazards created by site activities.

Perform exposure monitoring/sampling as well as personnel monitoring in accordance with paragraph 7-6 titled *Exposure Monitoring/Air Sampling Program*. Compare the resulting data with established "action levels." Initiate the appropriate corrective actions as necessary.

- (3) Accident Prevention. The contractor's SSHP will serve as the Accident Prevention Plan (APP) and activity hazard analyses (phase plans) as required by FAR Clause 52.236-13 and USACE EM 385-1-1. Thus, a separate APP is not necessary. Any additional topics required by EM 385-1-1 must be addressed in an accident prevention section of the contractor's SSHP. Daily safety and health inspections must be conducted by the SSHO to determine if operations are being performed in accordance with the contractor's SSHP, USACE and OSHA regulations, and contract requirements. In the event of an accident/incident, the contractor must immediately notify the contracting officer's representative (COR). Within two working days of any reportable accident, the contractor must complete and submit to the contracting officer (CO) an Accident Report on ENG Form 3394 in

accordance with AR 385-40 and USACE supplements to that regulation.

- (4) Staff Organization, Qualifications, and Responsibilities. The organizational structure must be discussed, including lines of authority (chain of command) and overall responsibilities of the contractor and all subcontractors for site activities, including supervisor/employee relationships. Summarize the operational and safety and health responsibilities and qualifications of each key person identified. Specifically:
- (a) A CIH or CSP with experience in hazardous waste site operations must be responsible for the development, implementation, and oversight of the contractor's SSHP and SHP. The SHP and SSHP must be signed and dated by the CIH or CSP prior to submittal.
 - (b) A fully trained and experienced SSHO, responsible to the contractor and the CIH or CSP, may be delegated to implement and continually enforce the safety and health program and site-specific plan elements onsite.
 - (c) At least one person certified in First Aid/CPR by the Red Cross, or equivalent agency, must be continuously present onsite during site operations.

7-3. Medical Surveillance. All personnel performing onsite activities must be participants in an ongoing medical surveillance program, meeting the requirements of 29 CFR 1926.65(f) and ANSI Z-88.2. A description of the general medical surveillance program is to be included in the contractor's SHP. All medical surveillance protocols and examination results must be reviewed, signed, and dated by a licensed physician who is certified in Occupational Medicine by the American Board of Preventative Medicine, or who, by necessary training and experience, is board eligible. The contractor's SHP may only describe the content and frequencies of any additional medical tests/examinations/ consultations determined necessary by the physician due to probable site-specific conditions, potential occupational exposures, and required protective equipment. Certification of participation in the medical surveillance program, the date of last examination, and name of reviewing occupational physician must also be included for each affected employee. The written medical opinion from the attending physician required by 29 CFR 1926.65(f)(7) must be made available upon request to the COR for any site employee.

7-4. Safety and Health Training. All personnel performing onsite activities must have completed applicable training in accordance and compliance with 29 CFR 1926.65(e) and EM 385-1-1. In addition, site-specific training covering site hazards, procedures, and all contents of the approved contractor SSHP must be conducted by the SSHO for onsite employees and visitors prior to

commencement of work or entering the site. The type, duration, and dates of all employee training performed must be listed by employee name and certified in the contractor SSHP. The following training information is general in nature but should be included in the SSHP.

a. Basic, Refresher, Supervisory, and Site Training.

- (1) No employee should be put into a hazardous field situation without training that includes an opportunity to practice job assignments in a nonhazardous situation. This section describes training requirements.
- (2) Before starting work on the site, an employee or subcontractor must complete a 40-hour basic hazardous waste safety and health training course that meets the requirements of 29 CFR 1926.65(e), the *OSHA Standard for Hazardous Waste Operations and Emergency Response*. The training is to be documented with a certificate signed by the course director. Basic training also includes at least three additional days of field or operations training under supervision. Supervisors are required to complete eight additional hours of hazardous waste management training.
- (3) On an annual basis, employees are required to complete eight hours of refresher training thereby meeting the requirements of 29 CFR 1926.65(e)(8).
- (4) Employees should complete a site-specific safety training/orientation that emphasizes:
 - Names of personnel responsible for site safety and health.
 - A discussion of the SSHP.
 - Site-specific safety and health hazards.
 - Exposure monitoring/personal exposure guidelines (e.g., PEL, TLV, IDHL, odor threshold, etc.).
 - Fire extinguishers.
 - Designated work zones.
 - Phase safety plans.
 - The nature of site hazards.
 - Use of personal protective equipment (PPE).
 - Decontamination facilities and procedures.
 - Work practices by which employees can minimize risks from hazards.
 - Site rules and regulations, including vehicle use.
 - Medical surveillance requirements, including recognition of symptoms and signs of exposure.
 - Confined space entry procedures.
 - Emergency and fire response.

- Material safety data sheets (MSDSs).
- Procedures for reporting hazardous conditions and practices.
- Safety and Health training requirements.

b. Training for Subcontractors.

- (1) Subcontractors are required to submit certification that they have met OSHA requirements for basic, refresher, and supervisory training before working on the site.
- (2) The SSHO should be responsible for conducting a task-or assignment-specific briefing for subcontractors seeking access to the site to perform work.
- (3) Training should be specific to the assignment or task and may include the same topics discussed in the previous section.
- (4) Subcontractors or authorized visitors may enter the site after completing this orientation, providing that in addition to meeting the training requirements, they possess appropriate medical and respirator certifications.

c. Visitor Training. Visitors and other individuals seeking access to the site must receive a briefing conducted by the SSHO as to their safety-related responsibilities. This briefing (typically 5 to 10 minutes in length) should include:

- Areas of site restriction.
- Discussion of the site evacuation warning signal.
- Discussion of the emergency egress route.
- Other topics as deemed necessary by the nature of the visit.

7-5. Personal Protective Equipment (PPE). The contractor's SSHP should include a written PPE Program that in accordance with 29 CFR 1926.65 (g) (5) and the respiratory protection program requirements of 29 CFR 1926.103. The contractor SSHP must detail the minimum PPE ensembles (including respirators) and specific PPE construction materials for each site-specific task/operation to be performed based upon hazard/risk analysis. Components of levels of protection (A, B, C, D, and modifications) must be relevant to site-specific conditions, including heat and cold stress potential and safety hazards. Site-specific procedures for onsite PPE use, limitations, training, fit testing, cleaning, maintenance, inspection, and storage and disposal should be included also.

- a. Level of Protection. The level of protection for the majority of site work tasks described in this UST Manual is anticipated to be Modified Level D as described in Table 7-1. However, the SSHO may upgrade to Level C if the "action levels" discussed in this plan are exceeded. Work must cease pending a complete reevaluation of the

site conditions by the CIH/CSP and SSHO should Level A and B conditions be anticipated or required once onsite.

- (1) Modified Level D. Employees and subcontractors will be required to wear the PPE designated in Table 7-1 for tasks that the SSHO determines to be Modified Level D. The SSHO is responsible for determining if liquid contaminant exposure could occur. These conditions may require taping of the joints at the wrist and ankle.

See Table 7-1 for PPE descriptions for Levels A, B, and C. Employees and subcontractors will be required to wear PPE as dictated by task according to the SSHO.

b. Respiratory Protection Program.

- (1) Employees and subcontractors are required to conform to the respiratory protection requirements of OSHA 29 CFR 1926.103 and EM 385-1-1. A written respiratory program as required by 29 CFR 1926.103(b)(1) should be incorporated as a part of the contractor's/subcontractor's written SSHP and provided with the SSHP to the contracting officer.
- (2) Employees and subcontractors must be required to submit evidence of respirator fit testing to the SSHO prior to performing tasks with the potential for upgrade to Level C or Level B. The documentation of qualitative and/or quantitative fit testing for survey personnel wearing respirators must include the following items for each individual: the manufacturer; the model; the size; the NIOSH Testing and Certification Number; the test results; the signature of the individual being tested; and the signature of the staff member who performed the fit test.
- (3) Before using a respirator, employees and subcontractors are required to perform an inspection and checkout in accordance with the manufacturer's instructions. All respirator users will conduct positive- and negative-pressure leak testing each time the respirator is worn to ensure satisfactory fit and valve function. The user will perform the following tests:
 - (a) Positive-pressure test: The user places the palm of his/her hand over the exhalation valve and exhales gently. If the respirator fits properly, the face piece should swell slightly.
 - (b) Negative-pressure test: The user covers both cartridges with his/her hands and inhales gently. If the respirator fits properly, the face piece should collapse on his/her face.

<p>TABLE 7-1 PERSONAL PROTECTIVE EQUIPMENT</p>	
Level D	<p>Work clothing, as dictated by the weather</p> <p>Safety (steel toe/shank) shoes or boots</p> <p>Chemical goggles or face shield</p> <p>Hard hat</p> <p>Nitrile, neoprene, or natural rubber gloves (use when handling or contact may occur with contaminated soils or similar incidents)</p>
Modified Level D	<p>Work clothing as dictated by the weather</p> <p>Safety (steel toe/shank) shoes or boots</p> <p>Hard hat</p> <p>Face shield (for pumping operations)</p> <p>Chemical goggles (for tank interior decontamination operations)</p> <p>Saranex or polyethylene-coated tyvek (or equivalent)</p> <p>Coveralls with hood (use when handling or contact may occur with contaminated soils or material, tank contents, tank interior decon, or other similar incidents)</p> <p>Nitrile, neoprene, or natural rubber overboots (use when handling or contact may occur with contaminated soils or similar incidents)</p> <p>Nitrile, neoprene or natural rubber gloves (use when handling or contact may occur with contaminated soils or similar incidents)</p>
Level C	<p>Same as for Modified Level D except for the addition of:</p> <p>Full-face, air-purifying respirator equipped with organic vapor cartridges</p>
Level B	<p>Same as for Modified Level D except for the addition of:</p> <p>Pressure-demand, full-face SCBA or pressure-demand supplied air respirator with escape SCBA</p>
Level A	<p>Pressure-demand, full-face SCBA or pressure-demand supplied air respirator with escape SCBA</p> <p>Fully encapsulating suit</p> <p>Inner gloves</p>

- (4) Facial hair (beards, sideburns, etc.) that interferes with the sealing surface of a respirator or interferes with its valve function is not permitted. A "one-day" growth of beard is considered to be interference.
- (5) Contact lenses must not be worn onsite. Each individual who requires visual correction must be provided with the appropriate corrective lenses that are made to be mounted inside a full face piece.
- (6) Employees and subcontractors are required to clean and disinfect their respirators thoroughly after each use or at the end of the day's activities. Respirator wipes may be used in the intervals.
- (7) Respirators must be stored away from dust, sunlight, heat, extreme cold, excessive moisture, damaging chemicals, and sources of mechanical damage.

7-6. Exposure Monitoring/Air Sampling Program (Personal and Environmental). Where there may be employee exposures to, and/or offsite migration potentials of, hazardous airborne concentrations of hazardous substances, then appropriate direct-reading (real-time) air monitoring and integrated time-weighted average (TWA) air sampling must be conducted in accordance with applicable regulations (OSHA, EPA, state). Both air monitoring and air sampling must accurately represent concentrations of air contaminants encountered on and leaving the site's exclusion/contamination reduction or support zones as deemed appropriate for the type of monitoring performed. Follow these guidelines for monitoring:

- (1) Utilize sampling and analytical methods following NIOSH (for onsite personnel and site perimeter locations) and/or EPA (for site perimeter or offsite locations) criteria.
- (2) Use laboratories successfully participating in and meeting the requirements of the American Industrial Hygiene Association's (AIHA) Proficiency Analytical Testing (PAT) or Laboratory Accreditation programs for personnel sample analysis.
- (3) Perform meteorological monitoring onsite as needed and use it as an adjunct in determining perimeter and any offsite monitoring/sampling locations. Where perimeter monitoring/sampling is not deemed necessary, provide a suitable justification for its exclusion.
- (4) Conduct noise monitoring as needed, depending on the site hazard assessment.

- (5) Compare all monitoring/sampling results to "action levels" established pursuant to "Hazard/Risk Analysis," in paragraph 7-2 above to determine acceptability and need for corrective action. As a minimum, develop action levels by taking into account the PELs, TLVs, odor thresholds, explosive limits of and monitoring instrument responses to the contaminants where this information is available.

Minimum action levels for benzene and gasoline (where applicable) and percent oxygen and lower explosive limits (LELs) must be as follows:

Benzene

0-1 ppm	Level D/Modified Level D
1-25 ppm	Level C/Modified Level C
> 25 ppm	Shut down operations and ventilate the area

Gasoline

0-30 ppm	Level D/Modified Level D
30-1,000 ppm	Level C/Modified Level C
> 1,000 ppm	Shut down operations and ventilate the area

Oxygen Monitoring

19.5%-22%	Normal operations
< 19.5%	Level B, shut down operations and ventilate the area
>22%	Shut down operations and ventilate the area

LEL

≤ 10%	Normal operations with monitoring
> 10%	Shut down operations and ventilate the area

a. Exposure Monitoring.

- (1) The SSHO should perform exposure monitoring to ensure that employees and subcontractors are not exposed to chemical contaminants above established exposure limits.
- (2) Conduct personal monitoring by taking breathing zone and general area measurements using direct reading instruments during work tasks that have the potential for exposure. When personnel are working on or near tanks or within trenches/excavations, the contractor should implement routine personnel air surveillance for the presence of air contaminants (gasoline, benzene, oxygen level, LEL, etc.). Air monitoring will be required whenever personnel enter a confined space or continuously during tank vapor purging/inerting. (For the purposes of this manual, purging means any method employed by the contractor to reduce the atmosphere in the tanks to less than 10 percent of the LEL. Inerting refers to methods used to reduce the oxygen content in

the tank to less than or equal to 8 percent.) Air monitoring will ensure that personnel are not exposed above OSHA PELs or ACGIH TLVs, whichever is more stringent.

(3) Follow these guidelines for environmental monitoring:

- (a) Conduct environmental monitoring by taking general area measurements using direct reading instruments during work tasks that have the potential to produce airborne contaminants that may migrate offsite.
- (b) Conduct confined space monitoring for all excavations greater than five feet in depth and continuously during the time workers are present in excavations.
- (c) Conduct air monitoring in storage tanks to ensure the tank has been adequately purged. The contractor must test all areas (top, middle, bottom) of the tanks in the event stratification has occurred.

When monitoring to ensure personnel safety, both oxygen content and LEL readings are required. When obtaining LEL readings, first verify the oxygen content of the space to provide for proper operation of combustible gas indicators. Oxygen levels less than 19.5 percent constitute IDLH conditions. (If the inerted nature of the tank is to be determined, only oxygen readings are required. Forced fresh air ventilation will be required when appropriate.)

Whenever air monitoring within the exclusion zone indicates Level C, PPE is required, as well as routine air monitoring at the boundary of the exclusion zone. The SSHO must expand the exclusion zone as necessary to ensure air concentrations do not exceed Level D action levels at the exclusion zone boundary.

- (4) Cold climates present special problems for monitoring instruments and monitoring in general. Instruments must be calibrated frequently and must be allowed time to warm up. Meters must be calibrated for the conditions of the vapor mixture to be measured and calibrated at the temperatures to be used. A rise in temperature of 10 degrees requires a calibration recheck and area resampling.

b. Exposure Monitoring Equipment.

- (1) The presence of organic vapors throughout the site area and in breathing zones must be determined using a real-time vapor monitoring instrument such as a PID or FID.

- (2) Equipment used for real-time environmental monitoring include Photoionization Detectors (PID), Flame Ionization Detectors (FID), and Combustible Gas Indicators (CGI). Many CGIs are also equipped to monitor oxygen and hydrogen sulfide levels in the atmosphere. This type of instrument is recommended for environmental monitoring and required for confined space work. Other monitoring equipment that may be necessary (depending on site conditions) is direct-reading colorimetric indicator/detector tube systems for measuring benzene. All instruments should be maintained and calibrated according to manufacturers' guidelines.

c. Phase Safety Plans. The following sections contain phase safety plans and are indicative of activities encountered in UST work. Each site will be different and, therefore, will contain different hazards. Each specific task will require separate descriptions. The following are examples of typical task descriptions:

(1) Surveying.

- (a) Task Description. Workers survey various sites for surface features and locations and elevations of all new monitoring wells.
- (b) Physical Hazards. Uneven terrain. Unsure footing, especially in wet conditions. Tick and snake bites. Rodents. Debris. Poisonous plants. Vegetation in some areas can hide hazards. Vehicle traffic. Overhead obstructions in buildings.
- (c) Exposure Hazards. Refer to the hazard analysis paragraphs (7-14) of this chapter for exposure hazards relative to UST work.
- (d) Level of Protection. Refer to the action levels discussed previously for the applicable action level for PPE.
- (e) Standard Procedures. The SSHO is required to measure the ambient air concentrations, check the site for physical hazards, and authorize the surveyor to begin surveying. The appropriate protective clothing is worn in accordance with the action levels specified. In some cases, Level C may be required, particularly in areas of significant contamination.

(2) Soil-Gas Survey.

- (a) Task Description. A soil-gas survey may be performed to investigate underground contamination from volatile chemicals (such as industrial solvents, cleaning fluids, and petroleum products) by looking for their vapors in the shallow soil.
- (b) Physical Hazards. Uneven terrain. Unsure footing, especially in wet conditions. Tick and snake bites. Rodents. Debris. Vegetation in some areas can hide hazards. Poisonous plants. Vehicle traffic. Heavy equipment is involved (i.e., medium-sized vehicle with lab equipment, sampling equipment, and a moderate-sized hydraulic press to drive sampler into soil). General safety precautions around heavy equipment should be observed.
- (c) Exposure Hazards. Refer to the appropriate portions (7-14) of this chapter for the exposure hazards. The borehole provides a conduit for hazardous vapors or fluids to reach the surface.
- (d) Level of Protection. Refer to the action levels discussed previously to determine the action level for PPE.
- (e) Standard Procedures.
 - Wear the appropriate protective clothing in accordance with the action levels specified. In some cases, Level C may be required, particularly in areas of significant contamination.
 - Wear leather gloves during activities that involve handling drill rig components and samples.
 - Know the location of underground and overhead utilities (electric lines, gas lines, and so forth). An installation representative, who is knowledgeable about the location of buried utilities, must approve all drilling and/or soil sampling locations.
 - Do not wear loose fitting clothing or jewelry.
 - Constrain long hair.
 - Do not touch or go near moving parts.

- Know the location of "Emergency Shut Off" switches. Should field maintenance on the drill rig be required, follow lockout/tagout procedures appropriate to the equipment and established in accordance with 29 CFR 1910.147.
- Stay away from operating equipment, particularly if the rig is located on unstable terrain.
- Minimize exposure time if close observation is required to complete an inspection.
- Allow properly equipped and protected personnel to respond in the event of an accident (hitting a gas line or drilling into heavy contamination). Immediately leave the area.
- Do not smoke or use spark-producing equipment around drilling operations, because flammable gasses may be released from the subsurface environment.
- Do not work during a rain storm because lightning could strike the rig. Heavy rain can increase the risk of sliding and falling, decrease visibility, and may make the equipment more hazardous to operate.

(3) Well Installation.

- (a) Task Description. Monitoring wells are one method that may be used to provide an access point for measuring groundwater levels and to collect groundwater samples that accurately represent in-situ groundwater conditions at the specific point of sampling.
- (b) Physical Hazards. Uneven terrain. Unsure footing, especially in wet conditions. Tick and snake bites. Rodents. Debris. Vegetation in some areas can hide hazards. Vehicle traffic. In addition, the following physical hazards may exist:
 - A major hazard of air rotary drilling can occur if the air compressor hose breaks loose and flies around uncontrollably, causing damage to equipment, serious injury, or death.
 - Explosion potential. Use of hollow-stem auger in methane- or gasoline-soaked soils represents a potential explosion.

- Stacked pipes can pose a hazard if one pipe falls and the stack collapses.
- Heavy equipment is involved (i.e., drill rig, compressor, water truck, flat-bed for drill rods). General safety precautions around heavy equipment should be observed.
- Hoisting the rope with a windlass during sampling provides a potential for injury if something slips or breaks.
- The weight used to drive the split-spoon is located overhead where disintegrating metal can fly anywhere if something breaks.
- Other physical dangers include: heavy rotating components, hoisting heavy materials overhead, material falling from the mast, and exposure to hot engine parts.

(c) Exposure Hazards. Refer to paragraphs 7-14 of this chapter for information on exposure hazards. In addition:

- Cuttings, drilling liquids, and groundwater may be contaminated. The presence of hazardous constituents should be evaluated, and the fluids managed accordingly. Avoid direct contact with these materials.
- The borehole provides a conduit for hazardous vapors or fluids to reach the surface. For example, methane in a landfill, vapors from buried drums, and contaminated groundwater can all be conveyed up the borehole. Respiratory and dermal protection may be needed.
- Rotary drilling with air can cause stripping of hazardous volatiles that may be present in the soil, and these vapors will be concentrated at the wellhead. For this reason, rotary air drilling may present a more serious inhalation hazard than drilling with other fluids.

(d) Level of Protection. Refer to the action levels discussed previously for the appropriate PPE.

(e) Standard Procedures.

- Wear the appropriate protective clothing in accordance with the action levels specified. Wear gloves during activities that involve handling drill rig components and samples. In some cases, Level C may be required, particularly in areas of significant contamination.
- Monitor all drilling activities with a CGI for explosive gases. Readings should be collected in the borehole whenever a sample is collected or drilling is stopped.
- Use common sense. Drill rigs are heavy equipment and should be respected as such.
- Know the location of underground and overhead utilities (electric lines, gas lines, and so forth).
- Walk completely around the rig before raising the drill rig mast in the vicinity of power lines. Determine the minimum distance from any point on the drill rig to where the nearest power line will be when the mast is raised and/or being raised. Do not raise the mast or operate the drill rig if this distance is less than 6 meters (20 feet).
- Minimum protective gear includes steel-toed shoes, hearing protection, hard hats, and eye protection.
- Do not wear loose-fitting clothing or jewelry.
- Constrain long hair.
- Do not touch or go near moving parts.
- Know the location of "Emergency Shut Off" switches. The driller and the SSHO must check the emergency kill-switch operation prior to commencing a drilling and/or sampling study and during the daily maintenance check. All malfunctions must be documented and reported to the project manager. All malfunctions must be repaired before drilling and/or sampling operations are permitted.
- Stay away from operating equipment, particularly if the rig is located on unstable terrain. If close observation is required to complete an inspection, minimize exposure time.

- In the event of an accident (hitting a gas line or drilling into heavy contamination), allow properly equipped and protected personnel to respond. Immediately leave the area.
- Do not smoke or use spark-producing equipment around drilling operations because flammable gases may be released from the subsurface environment.
- Do not work around a drill rig during a thunderstorm because lightning could strike the rig. Heavy rain can increase the risk of sliding and falling, decrease visibility, and may make the equipment more hazardous to operate by decreasing friction on the rope around the windlass.
- Wear the appropriate respiratory and dermal protection if exposure to hazardous vapors or contaminated cuttings and fluids is a possibility.

(4) Groundwater Sampling.

- (a) Task Description. Groundwater wells at various sites are developed, sampled, and the water level measured.
- (b) Physical Hazards. Metallic well parts can cut hands. Uneven terrain. Unsure footing, especially in wet conditions. Tick and snake bites. Rodents. Debris. Vegetation in some areas can hide hazards. Vehicle traffic.
- (c) Exposure Hazards. Refer to the appropriate portion of this chapter for exposure hazards. (See paragraphs 7-14.)
- (d) Level of Protection. Refer to the action levels discussed previously for the appropriate PPE at the specific site.
- (e) Standard Procedures. Refer to Appendix C for the procedure for opening and sampling wells. Wear the appropriate protective clothing in accordance with the action levels specified. In some cases, Level C may be required, particularly in areas of significant contamination.

(5) Soil Sampling.

- (a) Task Description. Collect soil samples at intervals during well installation, and collect soil borings at specified locations.

- (b) Physical Hazards. Refer to above for the hazards of drilling rigs. Uneven terrain. Unsure footing, especially in wet conditions. Tick and snake bites. Rodents. Debris. Vegetation in some areas can hide hazards. Vehicle traffic.
- (c) Exposure Hazards. Refer to the appropriate portion of this chapter for exposure hazards. (See paragraphs 7-14.)
- (d) Level of Protection. Refer to the action levels discussed previously to select the proper action level for PPE.
- (e) Standard Procedures. Wear the appropriate protective clothing in accordance with the action levels specified. Gloves are worn during sampling activities. In some cases, Level C may be required, particularly in areas of significant contamination.

7-7. Heat/Cold Stress Monitoring. Implement heat-and/or cold-stress monitoring protocols as appropriate. Determine work/rest schedules based upon ambient temperature, humidity, wind speed (wind chill), solar radiation intensity, duration and intensity of work, and protective equipment ensembles. Develop minimum required physiological monitoring protocols that will affect work schedules. In cases where impervious clothing is worn (full body), follow the NIOSH/OSHA/USCG/EPA *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities* protocol for prevention of heat stress. Commence heat-stress monitoring at temperatures of 70 degrees F. and above. Where impervious clothing is not worn, the most current published ACGIH heat-stress standard threshold limit values (TLV) must be used. To help prevent frostbite and hypothermia, reference and follow the most current published ACGIH cold-stress standard as a minimum. See Appendix D for heat- and cold-stress procedures.

7-8. Standard Operating Safety Procedures, Engineering Controls, and Work Practices. The elements outlined below must be addressed in the SSHP as a minimum.

a. Site Rules/Prohibitions.

(1) Buddy System.

- (a) USACE safety and health policy requires each employee entering a hazardous waste operation to be accompanied by a "buddy." A buddy provides co-worker/partner with assistance; observes partner for signs of exposure; periodically checks the integrity of partner's PPE; and notifies the SSHO if help is needed.

- (b) Because the buddy must provide help, the buddy must be in sight or hearing of the employee, and be prepared to enter any area the employee enters. Thus, the buddy must be fully certified to work in the level of protection that the employee is working in, and must have the appropriate PPE available. Personnel should not enter any area to assist their buddy unless another backup is available in the case of an emergency.
 - (c) Personnel who can provide emergency assistance in the event of injury or illness can serve as a buddy. Persons able to serve as buddies include: USACE personnel; subcontractor employees; federal, state, and local regulatory agency employees; and facility operators and their employees.
 - (d) Persons not able to serve as buddies include: members of the general public or reporters, clerical staff, persons not wearing the level of protection used in the work area, and persons not certified to wear the level of protection used in the work area.
 - (e) The use of buddies other than USACE personnel is approved only on a case-by-case basis by the CIH/CSP or the SSHO. The buddy must agree to, and be aware of, the responsibilities of a buddy as defined above.
- (2) General Safety and Health Rules.
- (a) All USACE and subcontractor personnel assigned to work on the site must be provided with a copy of the SSHP and must attend a daily safety briefing before commencing work.
 - (b) MSDSs for all chemicals brought to the site must be filed onsite. All project personnel will be informed of their location and availability.
 - (c) No one will be permitted to work alone on the site—the buddy system will be followed.
 - (d) Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited in any investigation area.
 - (e) Hands and faces must be thoroughly washed upon leaving the work area and before eating, drinking, or other activities.

- (f) Whenever decontamination procedures for protective clothing are in effect, the entire body must be thoroughly washed as soon as possible after the protective clothing is removed.
 - (g) Medicine and alcohol can increase the effects of exposure to toxic chemicals. Personnel using prescription drugs must inform the doctor prescribing the medicine of potential contact with toxic materials. Field employees taking over-the-counter drugs within a day before work on a site must inform a physician of intentions to perform hazardous waste operations while using the drug.
 - (h) Alcoholic beverage intake will be prohibited during the work day. Personnel under the influence of recreational or illegal drugs will not be allowed onsite and may face disciplinary action.
 - (i) Wearing of contact lenses onsite is prohibited.
 - (j) Wearing of beards by individuals assigned to tasks that require or may require respirators will be prohibited. A one-day growth of facial hair that interferes with respirator-to-face seal is considered to be a beard.
 - (k) All personnel working in exclusion zones must process through decontamination before eating, drinking, and/or smoking.
 - (l) Before initiating any nonroutine operation, personnel must consult SSHO about safety and health requirements for the operation.
- (3) Site Safety Practices. Historically, one of the major causes of physical injuries at sites is slips and falls. To prevent this hazard, pick up tools, parts, and other equipment. Grease droppings, oils, and sludge must be cleaned up as soon as possible. Use warning signs, railings, and in-place covers to protect against low piping, open tanks, and open manholes or hatches. The simple knowledge of proper lifting techniques can save many strained or injured backs. There are a host of general practices that require training to ensure personnel safety during operation of the site. A few are detailed below:
- (a) Do not run except in emergencies.
 - (b) Do not operate moving equipment unless instruction in its use has been given, and use is authorized by the SSHO. Only properly licensed personnel will be authorized to move heavy equipment.

- (c) Do not perform onsite equipment maintenance unless specific lockout/tagout instructions are given by the SSHO and specific lockout/tagout procedures for the equipment are established and followed.
- (d) Observe driving regulations within the site. These include wearing seat belts at all times when the vehicle is in motion and maintaining speeds under 15 miles per hour.
- (e) Remove safety equipment or supplies from their normal location after SSHO authorization.
- (f) Position safety devices, safety guards, and chains in place before equipment operation.
- (g) Improvised staging and structures are not permitted.
- (h) Carry a portable two-way radio for emergency and related use (applies to all USACE personnel). The SSHO should always carry a two-way radio.
- (i) Keep hand tools and special tools clean and in good repair.
- (j) Have the SSHO mark and inspect temporary lines, power cords, and outlets prior to use.
- (k) Locate buried cables and underground utilities prior to intrusive activities (such as excavation).
- (l) Use the correct tool for the particular job in the proper manner.
- (m) Carry materials and tools with concern for overloads and balance; these items must be securely held.
- (n) Avoid movement with obscured vision.
- (o) Practice good housekeeping at all times.
- (p) Use solvents and volatile liquids for periodic cleaning, etc., with SSHO authorization. Follow proper storage and disposal guidelines.
- (q) Do not practice "horseplay;" any frivolous behavior that increases the probability of an accident.

b. Material Lifting.

- (1) Many types of objects are handled in normal operation and maintenance at sites. Care should be taken in handling heavy or bulky items because they are the cause of a considerable number of accidents. Be certain employees know the following fundamentals of proper lifting to avoid back injuries:
 - (a) Consider the size, shape, and weight of the object. A worker should not lift more than one person can handle comfortably.
 - (b) Place the feet far enough apart for good balance and stability. *THE FOOTING SHOULD BE SOLID.*
 - (c) Get as close to the load as possible. The legs should be bent at the knees.
 - (d) Keep the back as straight as possible.
 - (e) Grip the object firmly.
 - (f) Straighten the legs from their bend to lift the object.
 - (g) Never carry a load you cannot see over or around.
 - (h) Set the object down by positioning yourself like you lifted; the legs are bent at the knees and the object lowered.
- (2) When two or more workers are required to handle an object, coordination is essential to ensure that the load is lifted uniformly and that the weight is equally divided between workers. Each worker, if possible, should face the direction in which the object is being carried. In handling bulky or heavy items, the following guidelines should be followed to avoid injury to the hands and fingers:
 - (a) Have a firm grip on the object.
 - (b) Make sure the hands and object are free of oil, grease, or water that might prevent a firm grip.
 - (c) Inspect the item for metal slivers, jagged edges, burrs, and rough or slippery surfaces.
 - (d) Wear gloves when possible.
 - (e) Keep fingers away from any points that may cause the fingers to be pinched or crushed, especially when setting the object down.

c. Fall Protection.

- (1) Falls are the second largest cause of physical injuries. Besides the fall hazards within the site, ladders and platforms present an accident hazard. Refer to procedures specified in the *USACE Safety and Health Requirements Manual* (EM 385 1-1) for the use of ladders.
- (2) Platforms and scaffolds must be inspected before use, so that they comply with the *USACE Safety and Health Requirements Manual* (EM 385 1-1).

d. Hand Tools.

- (1) Refer to *USACE Safety and Health Requirements Manual* (EM 385-1-1) for guidance in the use of hand tools. Only use tools that are in good condition. Improper and defective tools contribute to accidents. Observe the following safe practices:
- (2) Use tools in the manner for which they were designed to prevent injuries.
- (3) Be sure of footing before using any tool.
- (4) Do not use tools that have split handles, mushroom heads, worn jaws, or other defects.
- (5) Do not use makeshift tools or improper tools.
- (6) Make sure that tools cannot fall on someone below when working overhead. Tie the tools to a line, if necessary.
- (7) Use non-sparking tools where there is a possibility of explosive vapors or gases.

e. Hoses. Observe the following rules when using hoses:

- (1) Inspect hoses for defects, cuts, loose clamps, improper fittings, etc., before use.
- (2) Never apply air from an air hose to any part of the body or clothing.
- (3) Use only standard fittings for all hoses.
- (4) All quick makeup connections must be secured.

f. Electrical Safety.

- (1) Guidance for electrical safety appears in the USACE *Safety and Health Requirements Manual* (EM 385-1-1). Most equipment at the site uses electricity as the power source. Only use equipment designed and installed in compliance with the National Electrical Code Fire Code No. 70 (1985), NFPA, on the site. Maintaining field equipment requires exposure to electrical hazards that may result in shock or death unless safe practices are strictly followed. When working with electricity, it must always be assumed that there is sufficient voltage and current present to cause injury.
- (2) All lockout and tagging of circuits must comply with the provisions of 29 CFR 1926.417 and EM 385-1-1. No work will be performed on any energized electrical circuits. De-energize electrical circuits by opening the circuit breaker or disconnecting the switch feeding them. Where no circuit breaker or disconnect switch exists, employ other methods to de-energize the circuit. After the circuit has been de-energized, test it with a voltage tester to make sure there is no voltage present. Before work starts on the circuit, lock the disconnect switch or circuit breaker in the open position with the worker's safety lock. Attach a warning tag to the switch or breaker with the worker's name on it.
- (3) When work is to be performed on electrically driven equipment, lock the motor disconnect switch or circuit breaker to that equipment in the open position with the worker's safety lock. Attach a warning tag to the switch breaker with the worker's name on it. Before work starts on the equipment, the worker must attempt to operate the equipment to make sure it is inoperative. Adhere to applicable lockout/tagout procedures in compliance with 29 CFR 1910.147 and EM 385-1-1.
- (4) Workers will adhere to the following general rules:
 - (a) Survey the work area to determine whether any part of an electrical power circuit, either exposed or concealed, is located such that the performance of work could bring any person, tool, or machine into physical or electrical contact with it.
 - (b) Acquire the SSHO's permission to open an electrical control panel.
 - (c) Do not use a part of the body to test a circuit.

- (d) Avoid contact with grounding conductors like water, pipes, drains, or metal objects when working on electrical equipment or wiring.
- (e) Wear an electrical protection ensemble specified by the SSHO when performing electrical work near grounding conductors.
- (f) Do not bypass or disconnect electrical safety devices.
- (g) Use only approved extension cords.
- (h) Use only tools with insulated handles.
- (i) Use only portable electrical devices with ground fault circuit interruption (GFCI) protection when utilizing temporary electrical systems.
- (j) Do not use metal-cased flashlights.
- (k) Do not wear jewelry.
- (l) Use grounded or double-insulated electric tools.
- (m) Keep all electric motors, switches, and control boxes clean at all times.

g. Mechanical Equipment Safety.

- (1) The SSHO must inspect all mechanical equipment before it is allowed on the site.
- (2) Accidents in using machinery and mechanical devices can be kept to a minimum by designing each job to prevent accidents. When any mechanical equipment is purchased, consider all points that affect safety; past accident experience with the kind of equipment should serve as a guide, and desirable safety features should be specified and included in the original design.
- (3) The SSHO should ensure that rules and safety practices in the use of mechanical devices are regularly followed and that the equipment is in proper working order, in keeping with all the safeguards that have been adopted.
- (4) Safety guards are furnished for protection. The following regulations must be followed:
 - (a) Remove guards only after equipment has been shut down, tagged, and locked out of service in accordance with 29 CFR

1910.147 and EM 385-1-1. Replace guards as soon as work is completed.

(b) Make sure guards are in place and operative when using machinery.

(c) Be thoroughly familiar with equipment before attempting to operate it.

(d) Do not stand on moving equipment while it is in operation.

h. Equipment Startup and Operation. Rules for safe operation of mechanical equipment may be summarized as follows:

- (1) No machine will be lubricated or adjusted while in motion, unless its manufacturer specifies this practice, and it is deemed prudent by the SSHO.
- (2) Belts, ropes, or other moving parts of equipment must not be guided or controlled by hand or foot.
- (3) Do not operate machines unless they are in good working condition. The mechanical equipment operators should perform daily maintenance checks. All malfunctions must be documented and reported to the SSHO and the project manager. All malfunctions will be repaired before operations are permitted.
- (4) Operators of mechanical equipment must place themselves in a "safe" position before putting the equipment into operation.
- (5) Shut off power and lock the equipment securely against all motion prior to repairs or adjustments. A warning sign must also be attached to the lock.
- (6) Never oil line shafting while in motion, unless its manufacturer specifies this practice.
- (7) The SSHO must authorize machine and apparatus operation.
- (8) No person should use equipment without prior instruction or experience.
- (9) Provide adequate clearance at machine installation; passageways must be kept free of stumbling hazards.
- (10) Illuminate machines adequately.
- (11) Keep steps, handrails, and floors free from grease and debris.

- i. Excavations and Trenching. All site excavations and trenching must comply with the provisions of EM 385-1-1 and 29 CFR 1926 Subpart P, *Excavations*.

(1) Excavations.

- (a) To prevent injury and property damage during excavation work, pre-excavation conditions (superimposed loads, soil structure, and hydrostatic pressure, etc.) study to evaluate changes that might occur or situations that might develop, and plan the job ahead. Conduct all excavating work in conformance with EM 385-1-1 and 29 CFR 1926.650 through 1926.653, including requirements for shoring or continuously sloping excavations in which employees are exposed to danger from moving ground.
- (b) The presence of underground facilities, such as utility lines (water, electricity, gas, or telephone), tanks, process piping, and sewers is a major hazard. If these are dug into, undercut, or damaged in any way, there may be injury or death to workers, interruption of service, contamination of water, disruption of processes, and expensive delays. Before excavation, the location of various utilities and their approximate depth below ground must be coordinated through the installation or local private utility district and marked by stakes in the ground. Contents of buried tanks and piping should be indicated on the location markings. If the contents are flammable or toxic, have proper protective equipment readily available in case of rupture. Indicate the bottom depth of the tank.

Make sure clearance to adjacent overhead transmission and distribution electrical lines is sufficient for the movement of vehicles and operation of construction equipment. The requirements stated in EM 385-1-1, 29 CFR 1926 and the National Electric Safety Code must be followed by the contractor.

- (c) Excavated, stockpiled materials or tank and equipment must not be placed closer to the edge of the excavation than a distance equivalent to one-half the maximum depth of excavation. Tarpaulins, sheeted barricades, or low built-up board barricades must be used to confine material to the immediate area.
- (d) Barricade excavations to prevent employees and others from falling into it. When an excavation must remain open for duration of the construction work, use barricades, fences,

horses, and warning signs. If the excavation must remain open during periods when the work site is unoccupied (i.e., overnight, over a weekend, and other similar off periods), place lighted barricades around the excavation to alert personnel and prevent them from falling into the trench. See EM 385-1-1 for safe access requirements.

- (e) Any excavation greater than or equal to 1.2 meters (4 feet) deep must be provided with two means of access to facilitate safe entrance and exit. Space the means of access so that no worker in the excavation will be more than 7.5 meters (25 feet) from one of them. Make accesses extend from the bottom of the trench to at least 1 meter (3 feet) above the surface of the ground.

j. Explosive Atmospheres, Ignition Sources, and Hot Work.

- (1) Some potential causes of explosions and fires include:
 - (a) Chemical reactions that produce explosion, fire, or heat.
 - (b) Ignition of explosive or flammable chemicals.
 - (c) Ignition of materials due to oxygen enrichment.
 - (d) Agitation of shock- or friction-sensitive compounds.
 - (e) Sudden release of materials under pressure.
- (2) Explosions and fires may also arise spontaneously. However, more commonly, they result from site activities, such as moving drums, accidentally mixing incompatible chemicals, or introducing an ignition source (such as a spark from equipment) into an explosive or flammable environment. Explosions and fires not only pose the obvious hazards of intense heat, open flame, smoke inhalation, and flying objects, but may also cause the release of toxic chemicals into the environment. Such releases can threaten both personnel onsite and members of the general public living or working nearby.

To protect against these hazards, the following should be done:

- Conduct initial entry and periodic monitoring in accordance with 29 CFR 1926.65(h).
- Monitor for explosive atmospheres and flammable vapor using a CGI.

- Keep all potential ignition sources away from an explosive or flammable environment.
- Use nonsparking, explosion-proof, intrinsically-safe equipment.
- Follow safe practices when performing any task that might result in the agitation or release of chemicals. Action levels for CGI monitoring appear in Table 7-2.

TABLE 7-2
ACTION LEVELS FOR CGI MONITORING

EXPLOSION HAZARD

<u>Limit</u>	<u>Action Guide</u>
0 - 10%	No explosion hazard; work proceeds
>10%	Explosion hazard; evacuate, vent

OXYGEN DEFICIENCY HAZARD

<u>Limit</u>	<u>Action Guide</u>
<19.5% Oxygen	Oxygen deficient; use supplied air
19.5 - 22% Oxygen	No oxygen deficiency hazard; work proceeds
>22% Oxygen	Potential explosion hazard; evacuate, vent

Reference: EM 385-1-1

- (3) No ignition sources (e.g., cigarette lighters, matches, or other flame-producing items) other than those required for the completion of the project, will be permitted in the exclusion- or the contamination-reduction zones. To eliminate potential ignition sources, follow these guidelines:
 - (a) Barricade and post work zones before any work is done that might release vapors.
 - (b) Stop burning or other work that might be a source of ignition.
 - (c) Eliminate all ignition sources from the area where flammable vapors may be present or may travel.
 - (d) Keep work zones free of all ignition sources from the time tank removal starts until the tank(s) is/are inerted, residues have been removed, and the tanks' interiors have been decontaminated.
 - (e) Post signs warning vehicles and other ignition sources to be kept out of the area.
 - (f) Do not perform work if the wind direction carries vapors into areas outside the work zones where they might produce a hazardous condition, nor perform work when an electrical storm is threatening the work site. Sparks caused by friction or electrostatic effects may also be an ignition source in flammable atmospheres, especially at low humidity. Proper grounding of metal objects and/or electrical equipment, together with the use of sparkless tools and localized humidity adjustment, may reduce this hazard.
- (4) Hot work on the tanks may be conducted only:
 - (a) When inerted and
 - (b) To the extent necessary to begin dismantling the tanks.

After decontamination of the tanks' interiors, hot work must not be performed unless combustible gas/oxygen monitoring indicates atmospheres within and immediately surrounding the tanks are noncombustible as defined in this chapter and Chapter 13. The hot-work prohibition includes welding, grinding, sawing, or other similar operations that could be expected to potentially generate combustion-producing temperatures or sparks, or that could produce potentially hazardous fumes or vapors. If hot work is to be conducted, the contractor must obtain a permit from the contracting officer prior to

conducting such work and will designate an individual at each hot-work site as a fire watch. This person's sole responsibility will be to monitor the hot work and have immediate access to the fire extinguisher located at each hot-work site. The contractor must obtain a new permit at the start of each work shift during which hot work will be conducted.

- k. Illumination. The SSHO should ensure that all work areas will be lighted to not less than the illumination intensities listed in 29 CFR 1926.65(m) and EM 385-1-1. To ensure this, work activities must be restricted to daylight hours.
- l. Confined Space Entry Program. The confined space procedures detailed in Appendix E must be adhered to where applicable.
- m. Drug-Free Work Environment. All UST projects shall comply with the Drug-Free Workplace Act requirements.

7-9. Site Control Measures. Personnel not directly involved with the project will not be permitted to enter the work zones.

- a. Work Zones. The exclusion zones should include an area 7.5 meters (25 feet) from the storage tank location and excavations. At the exclusion zone perimeter, the contractor must establish a contamination-reduction zone. Within the contamination-reduction zone, equipment and personnel should be cleaned following the guidelines provided in this chapter and Chapter 9. The contractor's site office, parking area, and other support facilities must be located outside the exclusion zone and the contamination-reduction zone, in the support zone. The minimum level of personal protection must be indicated in the SSHP. The boundaries of the work zones must be clearly demarcated and posted by the contractor. A site map must be included in the SSHP outlining the extent of work zones and support facilities. The contractor must maintain a register of all personnel visiting, entering, or working on the site.
- b. Signs. Warning zones should be posted at the exclusion zone perimeter stating:

Hazardous Area - Keep Out Danger - No Smoking Authorized Personnel Only

The signs must be printed in large, bold letters on contrasting backgrounds. Signs should be visible from all points where entry might occur and at such distances from the restricted areas that

employees may read the signs and take the necessary protective steps before entering.

- c. OSHA Jobsite Posters. OSHA jobsite posters must be posted at each site.
- d. Vehicle Operation. Site personnel are expected to comply with all relevant traffic safety laws. They must obey the applicable speed limits. Whenever operating a moving vehicle, personnel must wear the seat belts provided.

7-10. Personal Hygiene and Decontamination.

a. Decontamination.

- (1) Decontaminate personnel who have come in contact with contaminated materials; they must not exit the work zones without first being decontaminated. Contaminated materials include soils that show visible evidence of being discolored or contaminated, decontamination fluids, and equipment that has come in contact with these types of soils or decontamination fluids.
- (2) Use suitable detergent as the decontamination solution and rinse. Items should be rinsed with clean water after washing. When temperatures fall to 32° F. or below, mix an additive into the decontamination solutions to prevent freezing.
- (3) Personnel who inadvertently become contaminated should immediately wash all contaminated areas. Clothing that is to be reused should be processed through the wash/rinse cycle three times and should be visually inspected by the SSHO to ensure no contamination remains. Any clothing that cannot be decontaminated in this manner must be discarded with the disposable clothing.
- (4) Containerize and dispose of used wash and rinse solutions as contaminated fluids.

b. Sanitation. In accordance with 29 CFR 1926.65(n), sanitary facilities must be provided to include drinking (potable) water, washing facilities, fire-fighting water, and toilet facilities. In addition, employees should be provided a clean area for food handling, as appropriate.

- (1) Potable Water. The SSHO must identify the closest source of potable water. If not sufficiently close, potable water should

be provided in tightly closed containers equipped with a tap. Sanitary, disposable cups should be provided, with a container to dispose used cups.

- (2) Washing Facilities. The SSHO must identify washing facilities located at the site that will allow workers to wash after decontamination, prior to leaving the site. Soap and disposable towels, with a container to collect the towels, should also be provided.

c. Toilet Facilities. The SSHO must identify toilet facilities to be located onsite for workers.

7-11. Equipment Decontamination. Refer to Chapter 9 for decontamination procedures.

7-12. Emergency Equipment and First-Aid Requirements.

a. Equipment. The following items, as appropriate, must be immediately available for onsite use:

- (1) Fire Extinguisher. Select and size fire protection based on site hazards; at the minimum, a Class 20A/20BC extinguisher shall be readily available onsite during all site activities. The fire extinguisher must be kept with the field crew during any drilling activity.
- (2) First-Aid Kit. Keep 16-unit first-aid kits in the support zone. Additionally, a minimum of two First-Aid/CPR-qualified employees must be onsite during project operations.
- (3) Portable Eye Wash. Portable eye-wash stations must be readily available onsite.
- (4) Portable Radios. If deemed necessary, portable two-way radios should be used as the communication link between each active site and the SSHO in case of emergency or related matters.

b. Communications and Notification Protocols.

- (1) Include emergency telephone numbers in the SSHP. Post these numbers and keep them readily available to members of the field crew. Discuss emergency communication in the safety meeting prior to initiating the field work. Each member of the field crew should know the location of the closest telephone.

- (2) Site notification protocols are listed below. Mitigate the emergency, then notify the appropriate emergency response service.
 - (a) In the case of a fire or explosion, call the local fire department.
 - (b) In the case of an accident or injury, the nearest hospital should be used.

c. Evacuation Procedures.

- (1) Withdrawal From Immediate Work Area. Withdrawal to a safe, upwind location will be required if any of the following occur:
 - (a) If concentrations of volatile organics, combustibles, or toxic gases exceed the action levels.
 - (b) Occurrence of a minor incident. Field operations should resume after first-aid and/or decontamination procedures have been administered.
 - (c) Heavy equipment or monitoring instrument malfunctions.
- (2) Withdrawal From Specific Site. The specific site will be evacuated in the following cases:
 - (a) Explosive levels of combustible gases exceed 10 percent of the LEL.
 - (b) A major accident or injury occurs.
 - (c) Fire and/or explosion occurs.
- (3) The SSHO should establish a safe refuge point and announce its location in the daily meeting.
- (4) Drill evacuation procedures on a periodic basis.

d. Contingency Procedures.

- (1) If an employee working in a contaminated area is injured or exposed:
 - (a) Move the employee to a clean area (on a stretcher, if needed).

- (b) Call for the necessary emergency medical response services (ambulance, fire, hospital, or poison control center) as detailed in the SSHP.
 - (c) Remove evidently contaminated clothing (if possible).
 - (d) Administer first aid, if you are qualified, and the situation warrants it.
 - (e) Evacuate other persons threatened by the condition.
 - (f) Arrange transportation to local emergency medical facility.
- (2) Emergency first-aid treatment is administered only by trained individuals and only to prevent further injury until professional treatment can be obtained.
- (3) If the injury to the worker is chemical in nature (e.g., overexposure), institute the following first-aid procedures as soon as possible:

Injury	Treatment
Eye Exposure	If contaminated solid or liquid gets into the eyes, wash eyes immediately at one of the emergency eyewash stations using large amounts of water and lifting the lower and upper eyelids occasionally. Obtain medical attention immediately.
Skin Exposure	If contaminated solid or liquid gets on the skin, remove contaminated clothing and wash the contaminated skin promptly using soap or mild detergent and water. Obtain medical attention immediately if there are any symptoms of exposure.
Breathing	If a person inhales large amounts of a gas or vapor, move individual to fresh air at once. If the person cannot breathe, provide artificial respiration. Keep the affected person warm and at rest. Obtain medical attention immediately.
Swallowing	If contaminated solid or liquid has been swallowed, contact the poison control center. Obtain medical attention immediately.

Provide the emergency medical facilities established for the site with a copy of the SSHP.

- (4) In the event of an emergency situation requiring evacuation of field personnel working within an exclusion zone, the following procedures should be followed:
 - (a) The SSHO should evacuate all personnel using a prearranged air-horn signal.
 - (b) Personnel leaving exclusion zones should exit through the contamination reduction zone unless that brings them closer to the hazard. They will decontaminate as planned unless the delay would pose an unreasonable risk to their safety.
 - (c) The SSHP identifies a signal for site evacuation. Equipment necessary to give that signal must be onsite. Practice a streamlined decontamination procedure to be used in the event of an evacuation. Practice evacuation procedures.
- (5) In the event of an explosion or fire at the site, the SSHO will take the following minimum actions:
 - (a) Evacuate all unnecessary personnel to a prearranged reassembly point (the safe refuge point).
 - (b) Request emergency response assistance from the fire department and from hospitals, poison control centers, etc.
 - (c) Notify the appropriate personnel.

7-13. Emergency Response and Contingency Procedures (Onsite and Offsite).
The contractor SSHP shall contain an emergency response plan in compliance with 29 CFR 1926.65(p), which addresses the following elements, as a minimum:

- Pre-emergency planning and procedures for reporting incidents to appropriate government agencies for potential chemical exposures, personal injuries, fires/explosions, environmental spills and releases, discovery of radioactive materials.
- Personnel roles, lines of authority and communications.
- Posted instructions and a list of emergency contacts: physician, nearby medical facility, fire and police departments, ambulance service, federal/state/local environmental agencies, CIH/CSP, Contracting Officer.
- Emergency recognition and prevention.
- Site topography, layout, and prevailing weather conditions.

- Criteria and procedures for site evacuation including emergency alerting procedures/employee alarm system, emergency PPE and equipment, safe distances, places of refuge, evacuation routes, site security and control.
- Specific procedures for decontamination and medical treatment of injured personnel.
- Route maps to nearest pre-notified medical facility.
- Criteria for initiating community alert program, contacts, and responsibilities.
- Critique of emergency responses and follow-up.

7-14. Occupational Safety and Health Hazards Associated With Tank Removal Processes. Workers should be aware of appropriate health precautions. When high concentrations of petroleum hydrocarbon vapors are inhaled, symptoms of intoxication, ranging from simple dizziness to excitement or unconsciousness, may result, and are similar to those produced by alcohol or anesthetic gases. If such effects occur, move the individual to fresh air. For minor effects of exposure, breathing fresh air or oxygen results in rapid recovery. If breathing has stopped, apply artificial respiration promptly, and obtain medical attention as soon as possible.

Subparagraphs b. and c. below contain special toxicity considerations for benzene and tetraethyl lead, which may be present in petroleum products or wastes found in underground storage tanks. Exercise care to minimize exposure to these substances during the handling of underground petroleum-storage tanks.

- a. Precautions. Tests have shown that prolonged or repeated exposure to some petroleum substances, in liquid or vapor form, may cause serious illness, including cancer, in laboratory animals. Although the significance of these test results to human health is not fully understood, exposure to petroleum substances should be minimized. The following health precautions are suggested:
 - (1) Avoid skin contact and inhalation of vapors.
 - (2) Keep petroleum liquids away from eyes, skin, and mouth; they can be harmful or fatal if inhaled, absorbed through the skin, or ingested.
 - (3) Use soap and water or waterless hand cleaner to remove any petroleum product that contacts skin. Do not use gasoline or similar solvents to remove oil and grease from skin.

- (4) Promptly wash petroleum-soaked clothes and avoid using soaked leather goods. Properly dispose of rags.
- (5) Keep work areas clean and well-ventilated.
- (6) Clean up spills promptly.

b. Benzene.

- (1) High occupational exposures to benzene have been associated with various human blood disorders, including an increased risk of leukemia. Very high levels have also been known to affect the central nervous system. Benzene administered by mouth has induced cancer in laboratory animals in long-term tests. Benzene is rapidly absorbed through the skin.
- (2) The OSHA imposes limits on occupational exposure. See 29 CFR 1926.1128.

c. Tetraethyl Lead. This organic form of lead can cause diseases of the central and peripheral nervous systems, the kidney, and the blood. Skin absorption of this compound is a major route of entry into the body. The ACGIH time-weighted average is 0.1 milligrams per cubic meter for general room air. The permissible exposure level (PEL) in OSHA's *Occupational Safety and Health Standards* (29 CFR 1910.1000, Table Z-1) is 0.075 milligrams per cubic meter.

d. Flammability and Combustibility Considerations.

- (1) Flammable or combustible vapors are likely to be present in the work area. The concentration of vapors in the tank, the excavation, or the work area may reach the flammable (explosive) range before venting is completed and a safe atmosphere is reached. Therefore, precautions must be taken to:
 - (a) Eliminate all potential sources of ignition from the area (for example, smoking materials, nonexplosion-proof electrical and internal combustion equipment).
 - (b) Prevent the discharge of static electricity during venting of flammable vapors.
 - (c) Prevent the accumulation of vapors at ground level. Refer to American Petroleum Institute (API) Publication 2015 and Recommended Practice 2003 for general precautionary measures to follow during tank sampling, product removal, vapor purging, inerting, excavating, and tank decontamination.

- (2) A CGI should be used to check for hazardous vapor concentrations (see Chapter 10, *Combustible Gas Monitoring Procedures*). All open-flame and spark-producing equipment within the vapor hazard area should be shut down. Electrical equipment (for example, pumps and portable hand tools) used in the area must be explosion-proof in accordance with NFPA 70B Class I, Division I, Group D or otherwise approved for use in potentially explosive atmospheres.
- e. Tank Safety and Health Work Practices and Procedures. Task-specific safety and health practices and procedures should be followed during the project in conformance with OSHA, USACE, and other applicable standards such as API Publications and Practices, and the following considerations:
- (1) Tank Contents Sampling. Personnel accomplishing this activity will initially wear Level D PPE as a minimum.
 - (2) Transfer of Materials out of Storage Tank(s). Use the following guidelines for material removal:
 - (a) Wear, minimally, Modified Level D PPE if you are engaged in material transfer activities or are within 7.5 meters (25 feet).
 - (b) Remove liquids and residues from the tank(s) following the procedures outlined in Chapter 12 titled *Product Removal Procedures* using explosion-proof or air-driven pumps.
 - (c) Ground and bond all pumps, motors, and hoses to prevent electrostatic-ignition hazards.
 - (d) It may be necessary to use a hand pump to remove the last few millimeters of liquid from the bottom of the tanks.
 - (e) If a vacuumtruck is used for removal of liquids or residues, the area of operation for the vacuum truck must be vapor-free. Locate the truck upwind from the tank and outside the path of probable vapor travel. API Publication 2219 and these guidelines will govern the vacuum truck operation and safety practices.
 - (f) Collect tank residues in drums, tanks, or tank trucks labeled according to DOT Standard 49 CFR Part 171 and Parts 1 and 2 and then dispose of them properly (Chapter 14).

- (3) Inerting Procedures. Following the removal of the tank's contents BUT PRIOR TO EXCAVATION OF THE TANKS AND TANK PREPARATION ACTIVITIES, insert the tanks in accordance with the tank inerting procedures presented in Chapter 13 of this manual. If dry ice is used, it should be introduced in the amount of at least 1.36 Kg (3 pounds) per 378 liters (100 gallons) of tank capacity. Skin contact with dry ice must be prevented by wearing heavy cloth gloves. Inerting must be sufficient to lower the oxygen content to less than or equal to 8 percent. *The contractor must confirm that the oxygen content of the tank is less than 8 percent before proceeding with additional activities on the tank (e.g., excavation).*
- (4) Excavating. Initially Level D PPE will be required for all personnel involved in tank excavation or within 15 meters (50 feet) of such operations. Modified Level D PPE will be used by personnel who may come into contact with the tank's contents or materials/soils that are contaminated with the tank's contents. Excavation of the tank including tank preparation, removal, decontamination, demolition, and disposal should be in accordance with the guidelines listed in Chapter 13 of this manual.
- (5) Decontamination of Tank Interior. Use API Publication 2015 to govern safety practices and procedures for the cleaning of the tanks. At a minimum, Modified Level D PPE should be used by personnel conducting decontamination operations.

7-15. Logs, Reports, and Recordkeeping. Develop, maintain, and submit the following logs, reports, and records to the COR at the conclusion of the site work.

a. Safety Inspection Reports.

- (1) Daily Safety Checklist. Conduct job-site safety inspections on a daily basis by the SSHO.
- (2) Weekly Safety Report. The SSHO should submit a cumulative daily safety checklist to the CIH/CSP for the preceding week. The SSHO should prepare a short cover memorandum describing any problems and/or deficiencies and how they were corrected.

b. Injury/Illness/Accident Reports. Injuries, illnesses, and accidents involving employees and subcontractors will be reported to the USACE using ENG FORM 3394.

c. Medical, Respirator Fit Test, and Training Certifications.

- (1) Medical, respirator fit test, and training certifications for USACE employees who work on the site should appear in Appendix A of the SSHP.
 - (2) If additional employees work on the site, their certifications should be forwarded to the USACE by the CIH/CSP.
 - (3) Medical, respirator fit test, and training certifications for subcontractors should be forwarded to the USACE by the CIH/CSP as they are contracted to work on the site.
- d. Training Logs. Document site-specific training, including subcontractor, "tool box," and visitor training.
- e. Monitoring Results. Document direct reading instrument (DRI) monitoring results in the logbook.
- f. Visitor's Log. An employee, subcontractor, and visitor log should be maintained by the SSHO.
- g. Phase Out Reports. Upon completion of the project, the CIH/CSP should prepare a phase-out report to include:
- (1) Summary of air monitoring data.
 - (2) Decontamination certification.
 - (3) Summary of accidents/injuries/illnesses.
 - (4) Other appropriate information.